Before the
Federal Communications Commission
Washington, D.C.20554

In the Matter of	)	(FCC 10-106)
	)	
Review of the Commission’s Part 95 Personal Radio Service Rules	)	WT Docket No. 10-119
	)	
1998 Biennial Regulatory Review - 47 C.F.R. Part 90 - Private Land Mobile Radio Services	)	WT Docket No. 98-182 RM-9222
	)	
Petition for Rulemaking of Garmin International, Inc.	)	RM-10762
	)	
Petition for Rulemaking of Omnitronics, L.L.C.	)	RM-10844

MOTION AND REPLY OF HAMPTON TECHNOLOGIES, INC.

Hampton Technologies, Inc. (hereinafter "Hampton") pursuant to the Commission’s Rules and Regulation, respectfully submits these Reply Comments and Motion responding to the Notice of Proposed Rule Making ("NPRM"), Docket 10-119.

BACKGROUND

Hampton designs and builds rapid deployment communication systems tailored for remote places. Its principals have been involved with Land Mobile Radio (LMR) since the 1960s and are licensees under Part 95. Hampton builds electronic equipment designed to be used in Part 95 radio systems, as well as other services.

0.1 The Focus Is Modernizing GMRS and FRS

Hampton shares the Commission’s goal to update Part 95 of the Rules but has limited comments to the General Mobile Radio Service (GMRS) and the Family Radio Service (FRS). Because Hampton sees potential for these services to ameliorate widespread problems, a comprehensive consolidation and modernization plan is offered together with its rationale.

0.2 The Plan Priorities Include:

1) improving the service for an underserved constituency,
2) sharing of this spectrum as a "commons" with all having use rights to all channels and all responsible for its fair distribution,
3) compensating for the current realities of the market, manufacturers and the installed radio base and,
4) making rule enforcement and spectrum management easier for the Commission and users alike.

0.3 Motion To Continue GMRS and FRS Modernization Rulemaking

The plan proposes more sweeping changes than the instant NPRM might have expected. It includes new rules requiring that radios provide specific interoperable and emergency modes as well as automatic station identification.

Therefore, Hampton formally asks the Commission to extend the GMRS and FRS modernization portion of this rulemaking, affording another round of comments focused on the issues herein.

Additional comments offer a broad opportunity to refine a plan. Seventy-five days toward consensus will be a good investment in half-century policy. Already, Hampton found several comments in the proceeding to be compelling; they caused earlier positions to be modified (as explained below). This may happen with other contributors too. Perhaps, the intermingled parts of the rulemaking might conclude.

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Section One

THE NEED FOR OUT-BACK RADIO:

A Discussion of Issues Guiding GMRS/FRS Reorganization

1.1 A Current LMR Assessment And How GMRS/FRS Is Affected

Obvious to all, technology has changed in the last few decades. In the United States, these technological innovations have allowed the Federal Communications Commission (Commission or FCC) to implement adroit regulatory adjustments, which transmuted land mobile radio (LMR) services. The effect of this regulatory/technological nexus was no less than changing ways our society works.

For proof, one need not look further than the cellular network. Cellular now connects eight out of ten Americans to the public switched telephone network. Cell phones find people where they are at the moment. Gone, is the need to be near a wireline phone. In fact, cell phones threaten extinction to pay phones and perhaps, even the home phone. Two decades ago, some trendy cellular services were not even dimly augured. Yet, despite the scale of its market penetration and the scope of its prodigious offerings, it is not a complete LMR service.

Cellular’s fundamental design provides a connection between two points, each momentarily confined to a specific location -- a one-to-one connection. Services needing to broadcast to a plurality of destinations -- one-to-many -- require another design. Teams taking turns talking to their whole group use a "fleet-dispatch" system design.

Fleet-dispatch users from public safety to construction crews have also benefited from the spate of technology and regulatory modernizations emerging with the new millennium. Both business and local governments found much relief when the Commission released new 800 MHz spectrum with new possibilities.

The fleet-dispatch technology companion to cellular is trunked-radio. Like cellular, it allows transparent computer controlled sharing of many radio channels by eclectic users. Unlike cellular, each trunked system tends to cover a larger area, principally because its one-to-many nature presumes the fleet is geographically scattered; so, trunked systems tailor their coverage size to the area over which the fleet tends to be distributed -- a "macrocell."

Arguably, fleet-dispatch macrocells are more efficient than selecting and connecting many scattered small cells into each transmission. While macrocells are located and sized such that they do not normally need interconnection, joining is possible when important.

Both cellular and trunked systems are a classic "win-win." These systems provide reduced access delay at higher levels of traffic intensity than past conventional systems. Put another way, they do a better job for more users while using less spectrum per customer.

There are limiting factors. Trunked and cellular have higher investment thresholds than conventional systems because they are infrastructure intensive with a critical customer size. There are no tiny systems. Each cell’s infrastructure must support several radio transceivers, a computer controller and a complex antenna system. Cellular always requires back-haul capacity with a control link; only a few trunked systems do. Both have significant tower site demands.

When user density is great, these costs are amortized without pain. When user density is low, these systems are not built.

Cellular and trunked systems were implemented on fresh spectrum because existing (legacy) radios on old channels would not work on the new systems. New radios were needed. Consequently, spectrum then used for mobile phones and fleet-dispatch was not available for building replacement systems. The process needed to be a spectral "diaspora" of sorts: users migrated from legacy radios on old spectrum to new radios on new spectrum. The old spectrum only became free when the diaspora was largely accomplished. That was part of the price.

1.2 Cellular And Trunked Systems: Metroplex To Boondocks

Cellular providers today use careful words describing marvelous coverage to high percentages of the population. Yet, remote areas have none. Even in rural areas, the best coverage is along well traveled highways. This is plain to see in FCC 10-81 FOURTEENTH REPORT of May 20, 2010, WT Docket 09-66, at Map 1. Simply put, remote areas have virtually no interconnected terrestrial two-way radio service at all and rural areas are spotty. Ranchers, farmers and people with fly rods already know this.

Without subsidy, this will remain true. Thin user density makes recovering Cellular investment unlikely. If this were not so, Cellular would have already reached every pasture and trout stream.

Trunked systems are no better. They may be common in urban settings but only occasionally extend into the countryside. A look at Sprint/Nextel’s coverage map shows vast geographic areas not now covered. Yet, they claim to cover 91% of the U.S. population and have

48 million customers; probably all true -- but, not the whole tale.

[see: (http://allwirelessinfo.com/images/nextel_map.png)
and, (http://shop.sprint.com).]

For all the success of cellular and trunked systems, people in the most rural decile of U.S. population must go to town to enjoy this prosperity while urbanites going to the out-back are disconnected. Concomitantly, technical evolution is freeing more people to play, work and live in more remote places. Radio services are not keeping up.

1.3 An Overview Of Out-Back Radio Needs

Out-back radio starts with a few people needing to communicate beyond earshot. FRS and PMR446 do this well. It would end there and the Commission could "de-license" GMRS channels for bubble-pack radios -- except, much more is needed.

When the stakes are high, it is dangerous to expect bubble-pack coverage much beyond 100 hectares (bubble-pack advertising, notwithstanding). It is not uncommon for out-back teams to be distributed over 50,000 hectares. Even a few people so distributed in a remote area with an urgent need for fast group communication, need infrastructure -- even if they must bring it with them. Cellular fails. Satellite phone will not do this. FRS has no infrastructure.

Demand for infrastructure can explode with uncommon events: fishing contest, hunting season, harvest time, round-up, lost camper, avalanche or a fire. So, out-back systems need to be nomadic: move quickly at low cost, triple capacity and/or range for a few days, then back to normal. Finally, out-back radio systems still need to have some basic functions not requiring infrastructure at all: simplex communications among simple radios. All this and compatibility too.

In short, out-back radio needs to be what GMRS always was; well, almost was. Out-back needs: base stations, repeaters, control stations, fixed stations, mobiles, portables and hand-helds -- as it now has. Yet, it has always needed telephone interconnection and now, add the Internet. Past regulation stopped telephone interconnect in a time when the Internet was not yet a DARPA dream. Before cellular, allowing interconnect would probably have saturated GMRS like it did the old urban mobile phone channels (IMTS, RCC, etc.). Things have changed.

While cellular will not meet out-back needs, its technological foundations can reduce regulatory restrictions and allow GMRS/FRS do the job. Now possible technical solutions -- which would be required by type acceptance -- allow human nature to enforce sharing of this spectrum. This idea is at the heart of the plan.

1.4 Check List For Out-Back Radio:

1) the need for low-cost rapid deployment and re-deployment of system infrastructure (high nomadic quotient),
2) normally low traffic intensity (e.g., less than five Erlangs per typical busy hour in a macrocell),
3) one person at a time may talk to many listeners (e.g., scoutmaster to scouts, rescue crew chief to searchers, rancher to cowboys, etc.),
4) basic phone-patch to the public switched telephone network,
5) data transmissions among users and Internet access,
6) radio communication among local talk-groups without fixed infrastructure (simplex and talk-around).

1.5 GMRS/FRS Can Be Out-Back Radio (Plan Overview)

Hampton intends to show a modernized GMRS/FRS service offering solutions to elusive problems in the United States. Further, similar problems exist in many parts of the world. The broad scope of the plan and its radios can be exported to South and Central America, Canada, Africa and beyond -- anyplace communications infrastructure is missing. All three ITU Regions have such places.

In the United States, the plan starts by shifting the urban common carrier service provider paradigm to diverse independent licensees investing in systems and infrastructure where these users see need. With only some clarification to the current Part 95 rules, GMRS/FRS spectrum could be licensed to individuals and cost-sharing non-profit co-operatives.

Next, the synergism is enhanced by permitting a broader scope of systems including: structured emergency communications, low power simplex channels, channels for repeaters and other types of base stations, interconnection to the public switched telephone network (PSTN), Internet access and a basic explicit digital transmission format that requires digital station identification while allowing all otherwise lawful data traffic.

This is all done within the context of distributed diversity principles: no auctions, no ownership rights -- just a spectral "commons" to be shared by all.

Importantly, -- with help from the Commission’s rules -- primary spectrum management is done by the licensees themselves. The first step relates to the correlation between bad behavior and anonymity;

because this is part of the human condition, automatic transmission identification is a type acceptance requirement; this denies camouflage to miscreants. Another step is the five minute rule prescribing sharing of the spectrum without monopolization. Other details are in Section Two.

As the instant comments sufficiently demonstrate, many GMRS licensees also hold amateur radio licenses. GMRS allows amateurs to share radio activities with friends and relatives on spectrum requiring less technical knowledge. Further, GMRS has less constraining pecuniary interest rules than amateur; it is more suitable for some of their activities. This dual licensing is advantageous because amateurs bring a successful history of sharing commons spectrum.

Likewise, many GMRS licensees are General Radiotelephone Operators (GROLs). As two-way radio professionals, GROLs have already managed spectral spats. Both GROL and amateur cross licensees can contribute as opinion leaders with helpful advice, exemplary conduct and technical expertise.

1.6 The Promise Synopsis

With little perturbation to the existing services, this plan: adds user flexibility, all but eliminates unlicensed use, allows continued use of legacy radios, shifts eligibility requirements to remove flagrant business use and encourage synergistic colleagues, quickly implements 12.5 kHz channels, allows many secondary transmission modes while requiring a primary interoperable voice and digital mode, requires new radios to identify automatically using standardized digital text, adds provisions for transponding status information, adds some required structure to the emergency use of these frequencies and finally, consolidates GMRS and FRS into one cohesive modern service without a spectral diaspora -- called GMRS/FRS.

1.7 The New Type Acceptance Deadlines (TAD)(TAD+)

A type acceptance deadline (TAD) should be set by the Commission’s process, as appropriate. [Hampton suggests January 1, 2012.]

Some implementation may need to wait (unless radios cause harmful interference) until after new radio requirements are already in place; this allows legacy radio amortization with reduced economic impact. This date is referred to as: TAD+ herein. [Hampton suggests five years after TAD.

[These dates need to be a subject in an extended proceeding.]

As often discussed herein, type acceptance will be the pivotal Commission management tool. Over time, it provides the leverage facilitating sharing of this spectrum as a commons, requiring little enforcement. Type acceptance will orchestrate:

1) technical features making anonymous transmissions unlikely,
2) rules requiring sharing of channels and limiting the time for exclusive channel use (only when others are waiting),
3) rules technically limiting interference prone features to licensees with something to loose and,
4) rules reducing inadvertent interference.

1.8 Type Acceptance And Legacy Radios

GMRS/FRS radios type accepted after the TAD shall be subject to the new rules. Radios type accepted for Part 95 prior to the TAD can be modified and continue in use as specified in Section 2.0 -- unless they cause harmful interference. After the TAD, radios using old type acceptance numbers can be sold (in the United States) by entities other than the manufacturers, as long as they are modified as specified in Section 2.0 and do not cause harmful interference; for the purpose of this proposal, "manufacturers" are the entity to which the type acceptance identifier is issued. Unmodified legacy hand-held radios can remain in service until TAD+ -- as long as they do not cause harmful interference (see 2.0.7).

1.9 A Regulatory Challenge And Opportunity

Stemming from the Commission’s earlier actions, radio manufacturers have developed and marketed millions of low-cost, hand-held, "bubble-packed" GMRS - FRS radios. They are widely used for outdoor fun: hunting, fishing, hiking, camping, etc. Reports have as many as 50 million units in service. If this estimate is true, possibly one-in-five U.S. households own a pair. This spawns a propitious synergism discussed later and a problem discussed next.

1.10 Apathy For Current Rules Suggests Change

In recent years, many of these fully type accepted bubble-pack radios include channels restricted to GMRS use. Since there are about 60,000 GMRS licensees, the numbers could suggest each licensee owns scores or even hundreds of these radios; it seems more likely there is much unlicensed GMRS use. Such serious violations of the Communications Act could occur because FRS users are unwittingly able to select a GMRS channel from the poorly differentiated list (a user interface design flaw). At first glance, GMRS license-by-rule might avoid this impropriety while offering a chance to simplify, streamline, update and reduce the administrative burden for the Commission, manufacturers and users. [The plan resolves this over time.]

1.11 The Search For Low Maintenance Rules

Antithetical to out-back needs, license-by-rule must avoiding unwanted consequences by restricting interference potential. While regulators hope for frugal enforcement, they are dubious about allowing repeaters, fifty Watts, removable antennae, phone interconnection, etc. One need look no further than: Canadian RSS 210, United Kingdom PMR446 and FRS. FCC 10-106 questions about these vary issues points to their regulatory significance. These are the very things out-back radio needs.

1.12 GMRS And FRS Exhibit Nested Convergence

Notwithstanding similar GMRS and FRS purpose statements, these services were never the same and have not drifted to equivalence. However, they are not mutually exclusive either. FRS is a wholly consistent subset of GMRS usage -- but, the converse is not true. Likewise, bubble-pack radios are wholly consistent with GMRS service -- but, a 50 Watt repeater would be disruptive if unlicensed. These facts point to a nested convergence -- part the solution.

1.13 The License Dilemma

The instant comments were largely generated by current GMRS licensees. Their observations lay bare this dilemma: further system restrictions will trash the value of GMRS for out-back service; absent system restrictions, license-by-rule invites chaos. Licensees seem vexed by the notion the Commission might abandon GMRS licensing AND reduce system flexibility -- saying that GMRS has achieved correspondence with FRS.

1.15 The Importance Of Legacy Radios

Any plan must deal with legacy radios. Within the current GMRS vision, legacy radios achieve needed features and link-budget requirements.

GMRS licensees will want to keep their high quality radios; they will see them as valuable existing investments. They may resent a Commission forced superannuation. Moreover, like amateurs before them, GMRS licensees will realize the opportunity stemming from the unfolding Part 90 radio replacements. Part 90 users will appreciate a waiting market.

1.16 Upgrading Legacy Radios

As the Commission knows, legacy radio integration been done before. In mid 20th Century, Radiotelephone Operators field converted thousands of last generation legacy UHF two-way radios by reducing their deviation from 15 kHz to 5 kHz. This can be done again. GMRS licensees can reduce today's legacy deviation from 5 kHz to 2.5 kHz on many high quality radios bringing their transmissions to that required for the 12.5 kHz channels and within the new emissions mask. Many GMRS systems have already thus converted legacy radios. Moreover, even the receivers can be modified to better suit the narrower channels (see www.com-spec.com, Narrow Band Kits).

Hampton has investigated a sample of legacy radios to ascertain upgrade feasibility. These radios will adjusted to 2.5 kHz deviation: Master Pro, Master II, RCA 700, RCA 1000, Aerotron CM, Aerotron 8, Wilson HH464, Force APU42 and Motorola Mitrek. No doubt, many more will too.

These same radios can accommodate the eventually required automatic ID modules described at: 2.2.3. While their audio passbands can be used for this data transmission, Hampton only tested their response to the modem tone frequencies. All of the above radios had adequate space for the small board required for this feature and would pass the modem tones nicely.

For modifying many legacy radios, the responsible GMRS licensees could seek assistance from the Commission’s licensees that have been tested for technical competence; most General Radiotelephone Operators (GROL) and amateur radio Operators have the instruments and expertise needed.

It was surprising to learn, resetting deviation on some of the newest model legacy radios (bubble-packs) is difficult because this parameter is firmware selected with no visible adjustment. When testing several such radios, the first sampling did not change deviation when moving from an FRS channel to a GMRS channel -- all channels used 2.5 kHz deviation.

Upon reading Garmin’s narrowbanding Reply Comments of September 20 (pages 9-10), Hampton purchased and tested Garmin Rino 130 units; using them with and comparing them to Motorola MR355 and Motorola T5500 units. The test equipment was an IFR 1200 Super "S" service monitor and spectrum analyzer. The Garmin unit does indeed change deviation from 2.5 kHz on FRS channels to 5 kHz on GMRS channels. The Motorola units do not: leaving the deviation at 2.5 kHz on all channels.

Furthermore, these tests demonstrate that Carson’s Rule (approximates required bandwidth) still works. When transmitting on a GMRS channel (467.575 MHz), the Garmin unit puts the predictable interfering energy into the adjacent 12.5 kHz FRS channels (467.5625 & 467.5875 MHz); the Motorola MR355, just as predictably, is less interfering because its deviation is less. To be fair, this is not the result of a poor radio; the Garmin unit was using the bandwidth they intended -- the bandwidth allowed by the current rules; the Rino 130 was just as "clean" as the Motorola when in the FRS mode. Moreover, Garmin can probably modify this specification with a simple firmware change and perhaps, sell such upgrade to their customers.

Hampton flatly states the Commission is NOT wrong in its "...conjecture that narrowbanding might reduce interference potential...(Garmin, P9)"; the Commission is obviously correct. However, Hampton thinks the paramount issue is the prospect of systemic malfunction in "real world" use (explained later). For now, Hampton takes Garmin’s suggestions (Garmin p10) a step further: require narrowbanding of radios manufactured after the TAD but allow the use of radios type accepted and sold by the manufacturer prior to the TAD -- unless they cause harmful interference. At TAD+ all legacy radios must be altered to comply with the narrowband requirements.

Adding the automatic ID feature to the modern bubble-packs may be the most difficult legacy radio upgrade -- perhaps more difficult than narrowbanding. Since there are user benefits to both narrowbanding and auto ID, there will be economic incentives to upgrade with aftermarket options and replacement radios. Failing that, the plan allows such legacy radio use without the automatic ID feature until TAD+ -- unless they cause harmful interference. Fortunately, most bubble-packs are cheaper to replace than other legacy radios.

These legacy exceptions put narrowbanding and automatic ID on the fast track with little economic threat. Current users are likely to see this as a fair solution and the approach will minimize concerns under the "Takings Clause" of the Fifth Amendment.

1.17 Narrowbanding Issues

1.17.1 Why narrowband at all?

Reason one: because it is already done. Channels interstitial to the original wide GMRS channels are assigned to FRS; they are narrow and, only 12.5 kHz away. GMRS was an obscure service and a lack-luster economic success until the Commission split these channels and created FRS. Then, the nexus of new technology, new rules, economic scope and scale took GMRS/FRS to a new place. People bought fifty million bubble-pack radios. It is silly to think one can "unring that bell." Arguments suggesting: "what should have been done is..." are not useful. It is time to make "lemonade."

Reason two: the new channels are needed; not always -- but, when there is concentrated activity (state fair, race track, boy scout camp, lost hiker) they can be needed now. They will be needed later. These additional channels are more valuable than slightly better performance claimed by wideband. Unless one believes GMRS/FRS can push aside other services now using adjacent spectrum, narrowbanding is the best path to new channels while still using legacy radios.

1.17.2 Why do it now?

Since one cannot yet act in the past, this is the best time remaining. Do it now so new radios are tailored to the new standard -- thus, minimizing the ambiguity causing Garmin to program their radios one way and Motorola to program theirs another. Community repeater operators can optimize their systems with less compromise and lower risk of systemic impairment.

1.17.3 Narrowband performance issues

Many instant comments focus on diminished narrowband performance. The usual concerns: signal-to-noise performance and coverage degradation of a few dB. [The comments look about the same as when this UHF band went from 15 kHz to 5 kHz.]

Regardless of the propagation model one chooses (Egli, Bullington, Longley-Rice, Hata, etc.), over real terrain a 3 dB change in the link budget will not change mobile system coverage much. Hampton concedes, under some circumstance, there is some merit in some arguments; yet, Hampton is not convinced narrowbanding represents a significant performance reduction. Actually, when optimal performance is required, secondary transmission modes are a better choice than wideband FM; good examples are: controlled carrier analog sideband or perhaps, a digital transmission techniques.

Surely most will accede, proponed narrowband deficiency do not eclipse new channel availability. Even when FM is the only choice, compatibility is more important than selecting narrow or wide. The following shows that deviation ambiguity is a more substantial issue than narrowbanding.

Assuming a team of volunteers searching for a lost child with some members having Motorola MR355 radios and others having Garmin Rino 130 radios; when the team selects GMRS channel 16, the Garmin radios adjust to 5 kHz deviation mode affording the maximum allowed by the GMRS rules. The Motorola radios adjusts to 2.5 kHz mode to avoid putting sideband energy into the adjacent FRS channels.

From the perspective of the Motorola radio, the Garmin modulation exceeds its passband and its filters reject most of the voice carrying energy. Only excessively close Rino 130 radios with soft talking users are understood at all. To the Garmin user, the Motorola radio has reduced loudness and is hard to hear. Ironically, both radios are working quite well -- but, the users think otherwise.

Actual measurements using a 1 kHz tone modulating a service monitor, demonstrated greater than 60 dB sensitivity reduction in narrowband receivers as the peak deviation increases from 2.5 kHz to 5 kHz (easy test, performed in minutes). This is the real wide/narrow argument. Deviation ambiguity serves no one -- not Motorola, not Garmin, not the lost child. Since GMRS integration with narrowband FRS is already a fact, why not have the radios work well together?

1.18 A Propitious Synergism

When trouble arrives and other infrastructure is missing or has failed, GMRS/FRS service is arguably, the most effective two-way radio available. Nothing else can as adroitly fill the urgent communication needs of ad hoc response teams. GMRS/FRS provides an eclectic class of service handling one-to-one conversations as well as the important one-to-many needed by teams. Volunteers looking for a lost child or rebuilding an earthquake ravaged city can use this service. GMRS/FRS is replete with good people willing to help and they already have millions of bubble-pack and legacy radios "at-the-ready."

Not only are these millions of radios ready, they are interoperable, now. No other service has radios as prepared for a commodious response. Unlike most urban areas, rural and particularly remote areas need volunteers for their emergency services. For them to bring their own always compatible radios -- radios they already know how to use --

radios they use for other things -- is very useful and cost effective. Cellular would be in the synergism contest except for their fleet-dispatch limitation and infrastructure dependency. Touting Citizen’s Band ignores the limitations of their spectrum.

GMRS/FRS works in spectrum needing only small antennae allowing handy radios; radiation directivity is accessible; propagation is not complicated by "skip"; electronic noise (natural and anthropogenic) is diminished; cheap electronics are apparent; so, epigrammatically, the GMRS/FRS channels are "beach-front" spectral property: among the most valuable.

1.19 A Glimpse At Public Safety Radio Cost And Ubiquity

Obviously, this discourse now impinges on public safety radio -- raising two important questions:

1) can public safety radio itself resolve ad hoc volunteer communication issues and,
2) if used this way, what prevents GRMS/FRS from becoming a lower cost de facto public safety radio service used by public safety for any of their activities.

Public safety radio (PSR) will not soon resolve the ad hoc volunteer issues because it is neither systematically uniform enough nor cheap enough. After many years of effort, public safety agencies still fail to achieve universal radio compatibility. Going only as far back as the Commission’s 1985 NPSAC initiative, there has been a focused effort to find ubiquitous interoperability among PRS users. Some progress has been made. APCO defined their P25 standard and such radios have better interoperability than predecessors. However, APCO P25 implementation is slow; progress is still thwarted by some efficacy questions and substantial cost.

Colorado has been among the P25 leaders, starting its statewide plan for interoperable radio in 1991. After almost twenty years, it was scheduled for completion by 2010 (Governor’s Office of Information Technology, www.colorado.gov) -- just in time for Boulder’s Fourmile Canyon fire. Yet, according to a RadioReference.com forum, "VHF Conventional Helped Save Boulder, CO Brush Fire" -- not the P25 state wide system. Even among the professionals -- emergency mutual aid fire-fighters that came from adjoining districts -- the best available radios were VHF units programmed to Boulder County’s VHF tactical channels; not P25 radios.

Setting aside the efficacy questions, cost is an issue. P25 radios are quite expensive: walki-talkies are more than $1400 each (little wonder they are scarce). The out-of-district help had VHF programmable walki-talkies (with a starting price of $139, see prices at: www.discountTwo-WayRadio.com). While P25 performance grumbling is easy to find, that was not the usual reported determinant in the VHF radio choice.

Juxtapose the prices above with a GMRS/FRS bubble-pack radio selling for less than $50 (www.amazon.com). Cost cannot be ignored. Obviously, if ad hoc volunteers are to bring their own radios, price elasticity affects the depth of the at-the-ready pool. At these thrifty prices, owning a pair of bubble-packs for emergency use is feasible; adding quotidian utility makes parting with the money easy. Moreover, everyday use trains ad hoc volunteers in the use of their GMRS/FRS radios.

[Hampton found its sampling of bubble-pack radios to have very adequate performance as purchased and tested. Of the twelve tested, one failed "out-of-the-box." Two more failed after a single field outing. While perhaps the fault of a slippery river-bottom rock, one additional unit failed to be waterproof (as the manufacturer predicted).]

1.20 Limit Government License And Permitted Communication

While it will be interesting to see what radios (VHF, P25, etc.) future mutual aid professionals take when the urgent call comes, the economics of this plan will cause ad hoc volunteers to bring their GMRS/FRS radios. These same economics might be too enticing to PRS; for this reason, the plan restricts PSR use to: coordinating activities with and among other GMRS/FRS users.

1.21 Encourage Public Safety And Public Services To Monitor

Because now practical technology will allow sheriffs, forest services, park services, red cross chapters, state police and other volunteers to monitor these channels for emergencies without having to listen to banal traffic -- they will listen. Flexible dial-up interconnection permits dispatchers hundreds of miles away to coordinate help in very remote places using radio effective but previously unrealistic sites; such sites become realistic when they are used and amortized by wider purpose. The suggested rules are designed to expedite these possibilities.

Even when circumstances are less exigent, the proposed service and systems provide capacity where other two-way services are thin or missing. When the scope of services is broad, the user base increases. As implied earlier, radio system costs are voluntarily borne because of everyday utility. Humankind can either find a way to integrate emergency use into pedestrian systems or it can subsidize stand-alone emergency systems. In the more remote areas of the world, the scope of modern urban radio is too narrow to be viable without subsidy.

Section Two
SPECIFIC RULE SUGGESTIONS

2.0 Types Of GMRS/FRS Radios

Microprocessors and application specific integrated circuits have been an integral part of two-way radio for more than twenty years. While suggestions herein require features not practical in the past, they can be implemented in modern radios with only modest development and insignificant manufacturing costs. New technology coupled with carefully crafted rules can solve intractable enforcement issues of the past while offering exciting new levels of service. This has been true for cellular, trunked radio, subscription satellite services and many more. Now is the time to raise the bar for GMRS/FRS.

All radios in this service manufactured after the TAD are required to:

- meet the Commission’s 12.5 kHz emission mask requirements,
- utilize the channel organization described in Table One and/or Table Two (see 2.2.5.1 & 2.2.5.2),
- restrict radio transmission requiring a license until the user has programmed the radio with the appropriate call sign and sometimes radio type (such user interface encumbers accidental misuse),
- meet the InteropID provisions of Section 2.2.3,
- meet the Push-To-Talk requirements of 2.4.8,
- each radio type has other specific requirements (see below).

Hampton suggests that many emission types, be permitted, providing they do not exceed the Commission’s 12.5 kHz emission mask and that type accepted radios always provide InteropVoice and InteropID as provided in Section 2.2. Hampton specifically cautions that emissions should include enough carrier content to be quickly detected by electronic means; for example, suppressed carrier sideband transmissions could be problematic (see Section 2.4.6, dealing with automatic data transmissions).

2.0.1 Repeaters And Telephone Interconnect

Repeaters are full-duplex radios able to receive on one frequency and simultaneously transmit on a different frequency. They are often shared infrastructure used by a plurality of licensees. Repeaters are identified using their owner’s call sign. Repeater owners may permit other licensees to operate their repeaters on a non-profit cost-sharing basis -- but, not otherwise.

Station Control

As permitted by the repeater licensee, these radios are controlled by:

1) A licensee acting as the station operator transmitting control signals to the repeater input frequency from a transceiver located in the repeater coverage area. Such control can place the repeater in one of two modes of operation:

   a) simplex-repeat mode -- the repeater retransmits traffic generated by the station operator on the input channel; the repeater stops transmitting within 1/2 second of input channel signal loss (likely, the repeater’s next transmission will be controlled by another station operator).

   b) phone-patch mode -- the control operator sends coded signals to the repeater causing its connection to the public switched telephone network; then, the repeater transmitter stays on and repeats both subsequent input channel traffic and PSTN traffic; while so connected, the repeater must receive continuing "keep-alive" input channel command signals from the station operator within each minute or the system will disconnect from the PSTN and stop transmitting (hang-up); further, there must be a station operator signal causing hang-up within one (1) second; repeaters placed in phone-patch mode must also monitor as described in Section 2.4.5, Rule Three and the station operator must be able to place the system into InteropVoice mode, as well (2.2.1). Interconnecting equipment must conform to FCC Part 68 Rules (47 C.F.R. Part 68).

2) A licensee acting as the station operator using local or remote control; in local control, the MonitorMode requirements of Section 2.4.5 are mandatory; this is true for remote control too and it is further regulated by Section 2.4.7.

3) A repeater licensee allowing a computer to act as a station

operator for the purpose of automatic data transfer as specified in Section 2.4.6. This technique can be used to forward data and send spontaneous status/requests; for example: inbound phone calls may cause a spontaneous data transmission locating a station operator to control the station during a phone-patch.

Repeaters always use the channels found on Table Two (2.2.5.2). They always transmit and receive on the channels 15R-22R. When operating under local or remote control, the station operator must monitor traffic on both the repeater input and output frequencies -- thus, the MonitorMode rules of Section 2.4.5 apply to both frequencies. [This is because station operators are responsible for monitoring the repeater output frequency; if they are not on the mobile side of the duplex pair, they need the extra receiver.]

Legacy radios type accepted for current use in Part 95 may be modified by the licensee to meet the post TAD repeater requirements. By the TAD, all repeaters must comply with the InteropID (2.2.3) and other InteropMode requirements with the following clarifications and exceptions:

1) repeaters need not retransmit all the traffic on their input frequency;
2) repeaters must pass or regenerate the InteropID packets associated with the traffic they repeat (2.2.3);
3) repeaters must automatically identify using the repeater call sign encoded into an InteropID packet just prior to ceasing its transmission;
4) repeaters may digitally transpond as provided at 2.4.6;
5) repeaters need not comply with FrequencyAgility (2.2.5) or ToneAgility (2.2.5.3) requirements;
6) station operators are responsible for traffic content;
7) repeaters are restricted to the 12.5 kHz emission mask;
8) repeaters are limited to 50 Watts output power except when used in aircraft (see 2.4.8);
9) repeaters require a license.

2.0.2 Base Stations

Base stations are usually at fixed locations and always under local or remote control governed by Section 2.4.7. They are simplex radios using channels 1-14 on Table One (2.2.5.1) with a maximum output power of 5 Watts (also known as small base stations) and they may also use channels 15-22 on Table Two (2.2.5.2) with a maximum output power of 50 Watts (except as aircraft limited by Section 2.4.7). [If they use channels 15R-22R, they are repeaters or control stations.]

Base stations must comply with the MonitorMode requirements of Section 2.4.5 and it they transpond, they must meet the criteria at Section 2.4.6.

All base stations manufactured after the TAD must fully comply with the InteropMode requirements at 2.2 including the ability to use all the channels found on Table One and Table Two adjusting the power according to the channel restrictions. [Thus, the same radio can be programed as a base, a small base, a control or mobile station, on the ground or in the air (with attendant economies) while type acceptance and microprocessors help avoid misuse.]

By the TAD, even legacy base stations must comply with the InteropMode requirements at: 2.2, except the FrequencyAgility (2.2.5) and ToneAgility (2.2.5.3) requirement. All base stations are restricted to the 12.5 kHz emission mask and must monitor before transmit as required in 2.4.5. Base stations require a license.

2.0.3 Small Base Stations

Small Base Stations are a low power subset of Base Stations using the simplex channels found on Table One; they must transmit and receive on the same frequency and they are limited to 5 Watts output power. High power base stations may be used as small base stations but they must comply with the lower power when operating on Table One channels (2.2.5.1). Small base stations require a license.

2.0.4 Control Stations

Control Stations are stationary and able to use one or more of the frequencies found on Table Two (2.2.5.2) to communicate through a repeater. They transmit on the repeater input channel and receive on the associated repeater output channel. They may be remotely controlled as prescribed at 2.4.7. They are limited to 5 Watts output power when using the repeater input channels. [Control station power is thus limited to reduce multiple repeater interference by encouraging more directive antennae.]

Radios manufactured after the TAD and used as control stations must be capable of transmitting on all the channels found on Table One and Table Two restricting their power to the base station limits when base station frequencies are selected and control station limits when using repeater inputs; in short, these new radios must comply with all the InteropMode standards in Section 2.2.

By the TAD, legacy radios must comply with the InteropMode standards at 2.2 except FrequencyAgility (2.2.5) and ToneAgility (2.2.5.3). All control stations must monitor before transmit as required in Section 2.4.5 and if they transpond, they must meet the criteria at Section 2.4.6. Control stations require a license.

2.0.5 Mobile Radios

Mobile radios are mounted in vehicles with their antenna located on the vehicle’s exterior. They may transmit on any frequency found on Table One using a maximum power of 5 Watts; they may transmit on any frequency found on Table Two using a maximum power of 50 Watts except when used in aircraft their power is limited by Section 2.4.8. Mobile radios manufactured after the TAD must comply with all the InteropMode standards at 2.2. New mobiles with more than 5 Watts output power need to limit their output to 5 Watts when using Table One channels. Mobile radios that transpond must meet the criteria at Section 2.4.6.

By the TAD, even legacy radios must meet the InteropMode standards at 2.2 except FrequencyAgility (2.2.5) and ToneAgility (2.2.5.3) and the MonitorMode requirements of Section 2.4.5. Legacy mobile radios exceeding 5 Watts output power are limited to the Table Two channels and 50 Watts. Mobile radios require a license.

2.0.6 Portable Radios

A portable radio is a small transceiver able to be used by a person holding it near their head when the antenna is attached. Portable radios have detachable antennae, which can be optionally mounted some distance away from the transceiver. The output power of portable radios is limited to 5 Watts. Portable radios may be used at temporary locations including from within a vehicle. Portable radios may use any of the frequencies found on Table One and Table Two. Portable radios manufactured after the TAD must meet all the InteropMode standards at 2.2. Portable radios must monitor according to Section 2.4.5 and if they transpond, they must meet the criteria at Section 2.4.6.

Legacy portable radios may be used after the TAD without meeting the

FrequencyAgility (2.2.5) and the ToneAgility (2.2.5.3) portions of the InteropMode standard -- unless they cause harmful interference. Their deviation must be adjusted to 2.5 kHz peak. All portable radios must monitor before transmit. Portable radios require a license.

2.0.7 Hand-Held Radios (FRS)

Hand-held radios are small radios with permanently attached antennae intended for use by persons holding the transceiver near their head. These are the only radios available for license-by-rule use on the Table One (2.2.5.1) frequencies.

Post TAD hand-held radios must also work on Table Two (2.2.5.2) frequencies after they are programed with a licensed call sign or when in the EmergencyMode (2.2.4). Hand-held radios that transpond must meet the criteria at Section 2.4.6. They must monitor before transmit as required in 2.4.5.

Post TAD hand-held radios are limited to 5 Watts ERPi peak envelope power; they must also have a 0.5 Watt ERPi setting on all channels to reduce interference potential and extend battery life. Thus, users have incentives to use only the power required as well as, the means to reduce power. As part of type acceptance, the Commission would require such radios to have a power switch. Further, hand-held radios must not have antennae detachable by normal user means and they must meet all the InteropMode standard at 2.2.

Legacy hand-held radios may continue in use if modified to conform with Section 2.2 including 2.5 kHz peak deviation; failing that, they may continue in use until TAD+ -- unless they cause harmful interference.

[Hampton found the comments supporting 5 Watt hand-held ERPi compelling and has modified this plan accordingly.]

2.0.8 Fixed Station Radios

Fixed Stations are radios using one or more of the channels found on Table One to communicate with other fixed stations. Fixed station radios can be modified legacy radios type accepted prior to the TAD or new radios; both must meet the requirements below and operate without causing harmful interference.

Fixed stations are limited to 5 Watts output power. Because they do not normally use voice to communicate with mobiles, portables or hand-helds, they are not required to implement ToneAgility, FrequencyAgility, or EmergencyDeclaration protocol -- but, they can. They are required to implement InteropVoice (2.2.1), MonitorMode (2.4.5) and InteropID (2.2.3) for standardized identification and channel coordination, when needed. Like all radios in this service, they are restricted to the 12.5 kHz emission mask.

Remotely controlled fixed stations must meet the criteria at Section 2.4.7. Fixed stations may be used to store and forward digital information; such data may originate and terminate at any point in the mobile radio system, the PSTN or Internet. Fixed stations that transpond must meet the criteria at Section 2.4.6. Fixed stations require a license.

2.1 Further Integration Of GMRS/FRS

Millions of bubble-pack radios have already caused some de facto conflation of GMRS and FRS services. Our earlier thought was for FRS to share all the channels with GMRS at reduced power levels. We found the contrary licensee comments compelling. Furthermore, a technical solution requiring licensees to enter their station call sign before GMRS features can be activated allows combination GMRS/FRS radios to be manufactured with much lower risk of unlicensed GMRS use, including the reserved channels.

This call sign entry idea offers attractive economies of scale to manufacturers and consumers alike and FRS users have an obvious path to GMRS use. Suggested new licensing procedures make obtaining a GMRS license inexpensive and easy; the life-time license term reduces administration cost to insignificant levels for the Commission and for the licensees. Also see 2.2.3 InteropID, for automatic identification detail.

2.2 Required Interoperability (InteropMode)

With a few exceptions, radios type accepted after the TAD shall conform to the requirements set forth in this Section 2.2. The exceptions are explicit at each type of radio in Section 2.0. The required interoperable modes are: InteropVoice, InteropID, EmergencyTraffic, EmergencyDelaration, FrequencyAgility and ToneAgility. The conventions and protocols are given below.

2.2.1 Interoperable Voice Mode (InteropVoice)

Legacy Repeaters, Base Stations, Control Stations, Mobiles, Portables and all new GMRS/FRS radios type accepted after the TAD shall be able to transmit plain analog voice, band limited to 300-3125 Hz.; this is the voice_band. Sub-audible frequencies below 300 Hz are reserved for control information using, for example: the required 32 sinusoidal tones listed in Table Three (2.2.5.3 ToneAgility) or subaudible digital information; this is the tone_band. The InteropVoice mode will be transmitted using F3E or G3E modulation with peak deviations of 2.5 kHz on channels spaced 12.5 kHz apart.

InteropVoice mode is compatible with most legacy radios after field modifications. Legacy radios must adjust their deviation to 2.5 kHz by the TAD; except, legacy hand-held radios unable to lower their deviation may continue with 5 kHz deviation until TAD+ -- as long as they do not cause harmful interference.

2.2.2 Required Data Mode (InteropData)

Except for legacy hand-held and portable radios, there is a data transmission mode required for all other radios by the TAD. While this is for the express purpose of digital identification and a robust emergency protocol, it can be used for nearly any digital traffic. Spectral efficiency of digital traffic can be ten times that of voice (see Hatfield, et al., "The Role of New Technologies and Spectrum Management in Meeting the Demand for Private Land Mobile Radio Telecommunications Capacity," NOI 82-10, also, Hatfield & Hampton, "SMRs vs. Cellular," Two-Way Radio Dealer, 1982).

A suggested implementation is given below. This technique is well explored; is in the public domain; is obvious to persons skilled in the art; can fit into the voice passband; can be committed to ASIC or DSP design; transmits its largest packet (50 simple words) in just over a second and identifies a transmission in about 1/8 second (less time than a "roger beep" but, real utility).

This data transmission technique is similar to what amateurs have done on VHF (Bell 202) since early OSCAR days; according to the 2010 ARRL Handbook, that continues today.

The proposed audio frequency shift keying (AFSK) tones occupy less audio spectrum than voice. They are easy to filter and record using common audio techniques.

With modest filters, the scheme will not perturb the subaudible band and the modem tones will pass though repeaters with little problem. The modem tones are transmitted using F2B/G2B unless the data are telemetry or telecommand: then, F2D/G2D. Aftermarket option boards can be made for legacy radios.

Hampton suggest an AFSK technique using 1200 Hz (mark) and 2400 Hz (space) as minimum shift keying (MSK) modem tones. These tones encode data bits into eight bit bytes organized into packets -- all using common RS-232 UART protocol including bit significance order.

Each symbol is either one-half cycle of 1200 Hertz (mark) or one full-cycle of 2400 Hertz (space) (sinusoidal wave forms).
As this protocol yields one bit per symbol, a bit time is about 417 microseconds and the bit-rate is 2400 bits/second. In data, each mark represents a binary one and each space a binary zero.

[The basic MSK patents expired many years ago; Scott Hall’s important MSK detection method patent (#4669095, Motorola, assignee), expired several years ago.]

Each transmitted byte begins with a space symbol (start) always followed by eight data symbols (marks and/or spaces)(no parity) always followed a mark symbol (stop). Thus, ten symbols construct a transmitted byte. A byte time is about 4.17 milliseconds. Each eight bit byte is transmitted with the least significant bit sent first (little endian).

2.2.2.1 Basic Packet Protocol And Universal Header

Packets consist of as many as 255 bytes. Packet transmission always start with a synchronization pattern (MarkedIdle-break-MarkedIdle). The pattern starts with continuous mark symbols (MarkedIdle). This MarkedIdle tone allows receiving equipment time to stabilize and synchronize to the modem tones (subcarrier detect). Normally, this first MarkedIdle duration is at least 50 milliseconds but this is extended to between one-half and one second if the packet is to be sent immediately after the transmitter is first keyed. Extending this MarkedIdle would allow time for repeaters to detect an input signal, check the frequency of a subaudible tone and allow the transmitter output achieve full power.

Following MarkedIdle is a "break." The break is thirty continuous space symbols (three byte times). For 12.5 ms, mark is absent. Breaks are not found in data. Many UARTs detect break conditions -- interrupting their microprocessors.

Following the break is another 12.5 ms of mark -- allowing adequate microprocessor preparation time for receiving the packet. This break sequence announces the imminent start of a packet.

Immediately following the break_sequence are three bytes:

1) the size byte, consisting of an eight bit unsigned binary number announcing the total size of the instant packet (including the size byte itself),

2) the checksum byte, set such that the modulus 256 value of all the packet’s bytes results in zero and,

3) the class byte, describes the remaining structure of the packet.

Two packet classes are reserved:
0) for transmission identification and,
255) for declaration of emergency mode.

Other classes are available for optional development. [also see 2.2.3 InteropID & 2.2.4 EmergencyDelaration.]

We ask the Commission to specify a standard data format to create a "level playing field": allowing automatic identification, assuring emergency transmission standards and further encouraging of spectrally efficient data transmission. This is a primary reason to extend these proceeding.

Hampton offers the technique above understanding there is room for criticism. One could argue that a Barker Sequence (not found in data) would make a better sync pattern than an RS-232 break. Further, a technique generating Hamming Syndromes (e.g., Golay) offering feed forward error correction, would be more robust. Hampton has used these. However, the instant question is one of cost and benefit: what low-cost technique is adequate to identify most signals strong enough to cause a -120dBm receiver to yield better than 12 dB SINAD? Weaker signals have little interference potential. Applications needing more robust data transfers could use an specialized optional even proprietary method.

Importantly, the required data technique must be available to any manufacturer unencumbered and without royalty; today, this should be possible. It seems likely the Commission would welcome comments here.

Hampton stands ready to support a better low cost open architecture idea.

Some comments suggest APCO P25 as a possible GMRS/FRS transmission mode with little cost information; recent investigations suggest this technology is surprisingly expensive. It should be noted, this InteropMode requirement does not preclude transceivers using secondary transmission modes including, for example, voice scrambling, P25 digital or single sideband voice. However, such secondary modes are not adequate as InteropVoice because they fail to include fifty million legacy radios. It will be interesting to see if P25 can be a good choice for InteropData.

Garmin clearly has a working data technique. Perhaps they have a good suggestion for a generalized open architecture data transmission scheme.

2.2.3 Automatic Transmission Identification (InteropID)

All new radios manufactured after the TAD and all legacy radios except hand-helds and portables will be required to identify each transmission using an InteropID. This is sent at the end of each transmission using the Required Data Mode above (2.2.2). The packet contains the station call sign (as entered by the licensee, if any) and the radio serial number assigned by the manufacturer. Legacy hand-helds and portables my be used until TAD+ -- unless they cause harmful interference.

The packet class byte (byte 3 in the packet) is set to zero (0) signifying an InteropID packet. This packet can also be used as an end-of-transmission packet: sent at the very end of all transmissions, voice or data.

Packet byte four is an 8 bit number (unsigned binary) signifying the number of following bytes containing the ascii coded station call sign (value would be: 4 for station W1AW or 7 for KAC7573). When there is no call sign (FRS only radios) this byte is zero.

Following the call sign would be some number of bytes that are the ascii coded representations of the radio’s serial number as assigned by the manufacturer; for legacy radios with add-on boards, this number would be assigned by that board’s manufacturer.

[The serial number could be an extension of the type acceptance number; this would reduce the coordination required for uniqueness.]

The serial number is all that is sent when radios are in the FRS only mode (no call sign). The size of the serial number can be deduced from the packet size byte and the call sign size byte.

While not a convention-by-rule, user groups could develop voluntary data bases correlating serial number to ownership.

2.2.4 Declaring Emergencies (EmergencyProtocol)

Hampton asks the Commission to establish an emergency protocol such as describe below. Rulemaking brings consistency and removes ambiguity most effectively.

Using the EmergencyProtocol would be similar to using the word

"MAYDAY" and have the same implication; except, the EmergencyProtocol can be used for periodic testing when the test transmissions are clearly marked as "TESTS." While not a convention-by-rule, licensees in each geographic area could form emergency management teams and appoint incident managers as appropriate.

The EmergencyMode uses a subaudible tone marking the transmission as part of an emergency communication session. This 67 Hz sinusoidal tone would modulate an InteropVoice transmission with between 300 and 500 Hz peak deviation. The tone could be used as a receiver squelch tone, to modify time-out features in automated equipment or for any purpose related to an emergency transmission. The rules would reserve this tone for EmergencyMode use on all channels and radios should be able to use this tone on all channels when in the InteropVoice mode; such use should be clearly marked as emergency use.

EmergencyDeclaration

When declaring an emergency the user puts the radio into EmergencyMode with an easy but error-resistant control. This forces the radio into InteropVoice, selects the use of the emergency squelch tone and allows the easy selection of either the emergency talk-around channel (15) or the emergency repeater channel (15R). Next, the declaration is initiated using an easy but error-resistant control. [This control must consider hand injury and the use of the mouth.]

Hampton does not suggest restricting these channels to emergency use. The protocol described herein protects EmergencyDeclaration receivers from normal traffic so they do not overlooking emergency calls. Using these frequencies and having them specified in the rules removes receiver frequency ambiguity. The specific channel was selected for current Canadian Boarder compatibility and the repeater possibility.

2.2.4.1 EmergencyDeclaration Packet

False declarations are resisted because this protocol uses both a subaudible tone and a data packet to declare an emergency. The declaration begins by placing the radio into the EmergencyMode then sending an EmergencyDeclaration packet on channel 15 (perhaps 15R too). The packet has a simple versatile structure describe next. It is sent at the start of a transmission. Following the packet, the user could send a voice message. At the end of the transmission, the radio will send an InteropID packet (2.2.3). This process could be repeated when not acknowledged.

The EmergencyDeclaration packet uses the basic packet protocol and universal header described at: 2.2.2.1. Because it is sent just after the transmitter is keyed, it will use one-half to one second of MarkedIdle tone. This also allows scanning receivers to detect subcarrier and watch for a declaration.

As is always the case, the first byte is the packet’s size. The second byte is the checksum. The third byte (packet class byte) is set to 255 announcing it is an EmergencyDeclaration packet. Subsequent bytes (if any) contain a human readable string of ascii characters.

After the EmergencyDelaration packet InteropVoice may be transmitted. As is always the case, the transmission ends with an InteropID packet identifying the call sign (if any) and always the radio’s serial number.

Once the emergency has been declared, an incident manager could select from all the channels to continue; further communication could be in EmergencyMode using the common tone or any other tone selected by the incident manager.

2.2.5 Required Frequency Agility (FrequencyAgility)

Frequency agility reduces the need for formal frequency coordination. More channel selection can be done on-demand: if one channel is busy at the moment, another can be used. On-demand coordination becomes more effective when radios scan selected channels looking for group collection identifiers such as subaudible tones or digital collection information. Required frequency and tone agility allows such flexibility and can triple spectral capacity while enhancing ad hoc readiness.

Radios type accepted after TAD would be required to have all the channels shown in TABLE ONE and TABLE TWO below. These would be available without adding options or altering the radio. Except for emergencies, hand-held radios require entry of a station call sign before the channels from TABLE TWO are functional. Because all other radio types require licensed use, such call sign entry must occur before their transmitters work.

We suggest the Commission modify its channel numbering scheme (95.103 and 95.403) to reflect the common scheme currently used by GMRS/FRS radios. This proposal numbers the channels from 1-to-22R divide into two tables: TABLE ONE are the channels available to hand-held radios used by virtue of license-by-rule (FRS). TABLE TWO are the additional channels available to GMRS licensees; FRS users may use TABLE TWO channels in pursuit of a declared emergency.

The tables also summarize the power limitations found in Section 2.0 for the various types of radios, making explicit how these limits affect the various channels.

2.2.5.1 Low Power Interstitial Simplex (Table One)

TABLE ONE

GMRS Small Base, Fixed, Portables and Mobiles are limited to 5 Watts output power on these channels.
FRS radios are limited to 5 Watts ERPi. Except for emergencies, these are the only license-by-rule channels.

Ch	Tx	Rx	Ch	Tx	Rx
1	462.5625	462.5625	8	467.5625	467.5625
2	462.5875	462.5875	9	467.5875	467.5875
3	462.6125	462.6125	10	467.6125	467.6125
4	462.6375	462.6375	11	467.6375	467.6375
5	462.6625	462.6625	12	467.6625	467.6625
6	462.6875	462.6875	13	467.6875	467.6875
7	462.7125	462.7125	14	467.7125	467.7125

2.2.5.2 High Power Repeater & Talk-around (Table Two)

TABLE TWO

GMRS Repeaters, Base Stations and Mobiles....50 Watts output.
Fixed and Control Stations...............5 Watts output.
Portables................................5 Watts output.
EXCEPT FOR EMERGENCIES, THESE CHANNELS REQUIRE A GMRS LICENSE.

Simplex/Talk-Around Channels			Duplex Only Repeater Channels		
Ch	Tx	Rx		Output	Input*
15	#462.550	462.550	15R	462.550	#467.550
16	462.575	462.575	16R	462.575	467.575
17	462.600	462.600	17R	462.600	467.600
18	462.625	462.625	18R	462.625	467.625
19	462.650	462.650	19R	464.650	467.650
20	462.675	462.675	20R	462.675	467.675
21	462.700	462.700	21R	462.700	467.700
22	462.725	462.725	22R	462.725	467.725

* Repeater Input channels may not be used for simplex operation; they are only used for duplex on associated frequency.
* Transmissions on input channels must be identified using a call sign as permitted by the GMRS licensee.
\# The EmergencyDeclaration Channels are used to declare an emergency using the emergency protocol (2.2.4); also, licensed users can use these channels for other activities.
Licensed-by-rule users (FRS) may use any of these channels in pursuit of declared emergency communications.

2.2.5.3 Required InteropMode Tones (ToneAgility)

After the TAD and when in the InteropMode, all new radios must be able to modulate the subaudible tone_band with the required sinusoidal tones found in Table Three (below) having an amplitude between 300 Hz and 500 Hz peak deviation. Some types of legacy radios are exempt from this requirement (2.0.1 through 2.0.8).

Hampton asks the Commission to establish this convention-by-rule to achieve service-wide compatibility. This recommendation is compatible with large numbers of existing radios both in terms of the frequencies suggested and their associated "code" numbers. This convention-by-rule does not prevent use of the tone_band by other schemes when the radio is NOT in the InteropMode or EmergencyMode.

TABLE THREE

Code...Hz	Code...Hz	Code...Hz	Code...Hz
#1.....67	2...71.9	3...74.4	4.....77
5...79.7	6...82.5	7...85.4	8...88.5
9...91.5	10...94.8	11...97.4	12....100
13..103.5	14..107.5	15..110.9	16..114.8
17..118.8	18....123	19..127.3	20..131.8
21..136.5	22..141.3	23..146.2	24..151.4
25..156.7	26..162.2	27..167.9	28..173.8
29..179.9	30..186.2	31..192.8	32..203.5

This tone is only used for EmergencyMode traffic.
- Other codes are optional, the codes above are required.

2.3 GMRS License And Eligibility

[GMRS would remain an operator licensed service not needing station licenses.]

GMRS licensees may operate stations anyplace the Commission has spectrum jurisdiction and in any other place where this spectrum is not regulated by any foreign government.

While legally visiting the United States, foreign amateur or GMRS licensees may operate -- according to FCC rules -- any equipment type accepted for GMRS/FRS service.

2.3.1 Term Of License Grant

Unless revoked for cause, GMRS licenses are granted for life. The Commission could, from time to time, require acknowledgement of FRN information validity. Such validity request could be spawned by computer launched e-mail, phone call or postal service. After a reasonable time, validation failure causes cancellation of all associated licenses.

This process would require very little effort on the part of the Commission or licensee. It would purge the Commission’s files after the death of a licensee -- or, for lack of further interest. [Licensees would need diligence in maintaining their FRN e-mail address.] The Commission could also cancel a license for cause.

2.3.2 Eligible Entities

Entities eligible for a GMRS operator licensing would be:

1) U.S. citizens or legal residents 18 years or older;
2) Amateur Radio licensees (regardless of age) may operate stations in this service under the GMRS rules (perhaps, licensed-by-rule); they would identify their stations using their amateur call signs;
3) current licensees may form not-for-profit entities organized to provide repeaters, base stations, control stations and fixed stations for its otherwise licensed members on a cost-shared basis; this license could not be used to identify traffic emanating from mobile, portable or hand-held radios);
4) not-for-profit entities organized under the laws of any State may hold a GMRS license and allow their associates to operate under their license as long as the communication only involves their benevolent activities;

5) U.S., State or Local Government entities may hold a GMRS license and allow their associates to operate under their license only for the purpose of coordinating activities with and among other GMRS/FRS users (perhaps, licensed-by-rule, identifying with one of their other valid call signs).

[Examples of not-for-profit groups: American Red Cross, Scout groups, 4H groups, amateur radio clubs, Audubon societies, etc.]

[Minors may lack adequate understanding leading to unwitting violation and reduced spectrum management efficacy. Minors can use GMRS radios with licensee’s supervision.]

[Business entities registered with local or state government as a for-profit business entity -- whether organized as an individual doing business as (d/b/a), a partnership or a corporation -- are not qualified to hold a GMRS license.]

2.3.3 Licensee Spectrum Management Responsibility

The instant comments reveal this dichotomy: Spectrum management is the chief reason for keeping the GMRS license; reducing government entanglement is the chief reason for eliminating the GMRS license. We believe this is not an exclusionary duality. Diremption is avoided with a viable plan facilitating GMRS licensees toward managing their own spectrum with little Commission administration or enforcement.

The Northern California GMRS Users Group uses an insightful Adam Smith intertextual metaphor when it suggest licensing is the Commission’s "invisible hand" (NCGUG at P7-8). Hampton agrees. In this plan, the "hand’s" embodiment begins with the licensee enlightened self-interest. Effective tools are added. Because of the type acceptance rules, the radio technology makes it easy to obey the sharing conventions and easy to spot a brigand.

This low regulatory overhang idea works for the Amateur Radio Service, satellite services, microwave services and Public Safety Radio Service. To us, it seems likely to work when there are licensees with something to loose and anonymous bad behavior is technically thwarted.

Licensees manage by example and advice. When this is not enough, they can tape record the bad behavior to provide good evidence for the Commission’s enforcement. Because of the post TAD type acceptance, such recordings would include the serial number of the radios involved and the operator’s call sign. [The Commission’s enforcement demand will be low because human nature has not changed much since Adam Smith’s time.]

Hampton intentionally "salts" the eligible user base with amateurs because they bring experienced resources: for example, American Radio Relay League (ARRL), Amateur Radio Emergency Service (ARES), Radio Amateur Civil Emergency Service (RACES), Military Auxiliary Radio System (MARS), National Voluntary Organizations Active in Disaster (NVOAD), etc. These groups have hundreds of years of successful spectrum management experience.

Moreover, the example group’s larger goals are often limited by rigorous (albeit, appropriate) amateur license requirements. The HAM/GMRS/FRS synergism brings millions of GMRS/FRS helpers with compatible radios (most days, used for other things) together with thousands of amateurs contributing knowledge and more. GMRS/FRS can help amateurs solve problems while amateurs facilitate GMRS/FRS success.

Likewise, public safety and public service users are added to the licensee base because of their obvious motives and skills. They bring EmergencyMode benefits to the GMRS/FRS users. Over time, they become even more available when trouble arrives in the out-back.

2.4 Permitted Communication And Operators

GMRS/FRS stations are to be used for the affairs of the licensee. Licensees may not charge for the use of their stations or to carry radio traffic for hire. Licensees may share the cost of radio systems among groups of licensees.

GMRS licensees may allow any persons obeying the operating rules to use their stations for any lawful communication. Any person operating under FRS or GMRS rules may communicate with any other GMRS or FRS user using voice or data as long as the transmissions are identified as specified in Section 2.2.3.

GMRS/FRS stations may NOT be used to transmit advertisements, music, or sound to attract attention.

2.4.1 Two-Way And One-Way Communication

The primary purpose of the GMRS/FRS band is two-way communication between individuals for any lawful purpose. Licensees that are not natural persons have further restriction on the types of communication permitted (see 2.3.2).

One-way communication is prohibited with the following exceptions:

1) to send an emergency message,
2) attempt to establish two-way communication,
3) to provide traveler assistance,
4) to provide brief station location or status information,
5) to conduct a brief test.

2.4.2 Pecuniary Interest

Only individuals holding a GMRS license or persons operating under FRS licensed by rule may have a pecuniary interest in their radio traffic. Corporations, partnerships and other groups holding a GMRS license may only use their license for non-profit non-pecuniary benevolent activities.

2.4.3 Responsibility For Repeater Traffic

The content of the traffic retransmitted by a repeater is the responsibility of the GMRS licensee transmitting on the repeater input frequency. The operation of the repeater is the responsibility of the repeater licensee. Traffic generated by operators using local/remote repeater control, is the responsibility of the repeater licensee.

Likewise, the content of traffic digitally forwarded by GMRS systems is the responsibility of the licensee generating the traffic.

2.4.4 Time Limited Use

Except for EmergencyMode traffic, users must allow others waiting for channel access to gain access every five minutes.

[This helps keep urban users from overwhelming this 400 kHz -- if for some reason they might prefer it to the superior and available cellular or trunked services.]

2.4.5 Monitor Before Transmit (MonitorMode)

[This plan forces the monitoring requirement of the current Part 95.175 (a) monitor rule into a type acceptance issue.]

After the TAD, radios will be able to prevent the hearing of traffic not directed to the selected group. Most radios have this feature now using tone coded squelch. This allows others to use the channels without disturbing the selected group; to them, the channel seems vacant -- even when it is not.

Governing Rule One: (must disable PTT until in MonitorMode)
By the TAD, all hand-held, portable, mobile, control station, base station and fixed station radios must disable the transmit keying circuit unless the receiver is in the MonitorMode.

Governing Rule Two: (visual indication of on-channel traffic)
When in the MonitorMode, transceivers will have a visual indication that their electronics have detected an on-channel radio carrier exceeding the noise squelch threshold even when the mode of operation does not render audio traffic.

Governing Rule Three: (coded squelch disable)
When in the MonitorMode, transceivers rendering audio to the user, must pass all voice_band audio generated by signals above the noise floor (noise squelch can still work but coded squelch circuits may not).

Governing Rule Four: (no audio requires TransponderMode)
When transceivers are not rendering audio to an operator they must use the TransponderMode rules in Section 2.4.6.

Thus, when the operator wishes to engage in dialogue, the radio must be put into the MonitorMode and any co-channel traffic will be heard (but, perhaps not understood). The visual indicator reveals even unmodulated radio frequency carriers. This would mean, users will also hear a very brief burst of InteropID announcing the end-of-transmission.

When transceivers with human operators are in the MonitorMode, user can transmit even when a co-channel signal is detected; the user must decide if the transmission will cause harmful interference. Small groups using repeater talk-around may do this often: knowing their signals will not disturb distant simultaneous repeater users; thus, users can decide when their system should be interference limited and when it should be noise limited. Moreover, some situations may require "stepping on them" -- just not anonymously.

When received signal audio is not heard by an operator transceivers are not allowed transmission if the receiver detects a co-channel signal; see special rules at Section 2.4.6. Legacy hand-helds and portables may be exempt from this rule until TAD+ -- unless they cause harmful interference.

Manual MonitorMode is not new. Similar monitoring has been done in two-way radio for fifty years. Other than hand-held and portable radios, most legacy radios implement some variation of monitoring, now.

Today, bubble-pack monitor controls vary from inconvenient to oppressive. When the manufacturer is not accountable for 95.175(a), they do what is easy for them and hope the user does the right thing. When type acceptance makes MonitorMode a transmit prerequisite, successful radio manufacturers will make it user friendly and enlightened self-interest works again.

Due to talk-around considerations, repeaters only need to monitor their input channels and assume signals with the correct codes are meant to be repeated. Repeater users must monitor the repeater output channel to prevent activating the Repeater when such would likely cause harmful interference. With MonitorMode they will.

2.4.6 Automatic Data Transfer (TransponderMode)

Automatic data transmissions allow information transfer with little user intervention. They are useful for data collection, and status information. Any otherwise lawful data traffic should be allowed. Hampton suggest the Commission revisit earlier restrictions on data forwarding and allow such under this new TransponderMode rule.

Data exchanges requesting, transferring and acknowledging transmittal is both efficacious and spectrally dense. They should be permitted and even encouraged -- yet, they are potentially disruptive due to limited electronic controller judgement. To reduce co-channel interference and capacity saturation, the following rules place occupancy and temporal limits on automatic data transfers.

Data transfers initiated by human operators listening to the channel using MonitorMode (2.4.5) are not considered automatic. However, even attended stations use these automatic data transfer rules when the operator does not listen to channel audio as prescribed by 2.2.5. Then, the operator may command the transceiver to send data (send-when-able) but the transceiver will actually transmit such data as a transponder.

Transponder transmissions are defined as transceivers automatically transmitting data because of event detection; for example: timeout, temperature change, battery low, sunrise detected, new location deduced, send-when-able command, data request received, forward-when-able, etc.

Some events are local to the transceiver’s control circuits and some can be the result of received radio packets. When the request-to-send is local, two-way radio contact has not yet been established. When the request-to-send is via the radio channel, two-way communication can be assumed. One-way transmissions -- even if they are an attempt to establish two-way, are more limited in duration; they are described as spontaneous transmissions herein.

Governing Rule One: (all automatic data transmissions)
Before an automatic data transmission, the radio electronics must monitor the channel for occupancy and delay transmission until it appears vacant for at least one second; if the transmission is through a repeater, the repeater output channel is monitored, otherwise, the transmit channel is monitored. Collision avoidance strategies must at least include randomized transmission delay: after the transceiver detects apparent vacancy, it must further delay a random amount of time -- watching for new activity before transmitting; if new activity occurs during the random delay, transmission is delayed until after the next vacancy -- which starts the cycle again. The randomized time boundaries are: 0-to-1000 milliseconds. Channel vacancy is electronically tested by detecting received in-band energy above the receiver noise floor. Type acceptance will test these parameters.

Governing Rule Two: (broadcast status and connection requests)
Spontaneous transmissions are one-way because a dialogue has not yet been established. Thus, spontaneous transmissions are limited to five (5) seconds duration.

Governing Rule Three:
Except for emergencies, stations may transmit spontaneous status information to all listening stations only three (3) times every 10 minutes.

Governing Rule Four:

Except for emergencies, stations may transmit spontaneous connection requests to single specific destinations only three (3) times every 10 minutes.

Governing Rule Five:

Except for emergencies, once a two-way connection can be assumed, data transmissions are limited to one (1) minute duration and the transceiver must wait the the delay as required in Rule One before subsequent transmissions.

Rules, such as proposed above, generalize the Garmin proposal of RM-10844 and permit both spontaneous data transmission and transponding transmission with reduced interference potential than simply allowing such transmissions without regard for channel vacancy.

Connection requests are limited to three requests in ten minutes so that unrequited requests do not saturate the channel. Three every ten minutes allows manufacturers to choose the best strategy: three in quick sequence then wait or more temporally distributed.

While it is not clear to Hampton how Garmin’s current units mitigate co-channel interference (if they do), their representation of: a half-million units in use for almost six years without REPORTED interference problems, is taken at face value and is significant enough to suggest their legacy radios be allowed continued use -- unless they cause harmful interference -- and, Garmin be permitted manufacture and sale of such product until the TAD. Beyond TAD+ however, there is potential for more intense use of this band. Garmin may want to make some representations to the Commission about this issue.

2.4.7 Remote Control

Repeaters, Base Stations, Control Stations and Fixed Stations can be remotely controlled from points connected to the transceiver using the public switched telephone network, the Internet, fixed wire, microwave, optical systems or other methods -- as long as the connection meets the control criteria in this section.

The station control operator is the person authorized by the station licensee to control the station;

Remote control using the Internet or PSTN requires a difficult to counterfeit coded sequence enabling the link.

If the control link is lost, station circuits must stop transmission within five (5) seconds.

The remote control point must put the station into MonitorMode (2.4.5) prior to keying the transmitter.

Remote control equipment must comply with FCC Part 68 Rules when applicable (47 C.F.R. Part 68).

Repeaters interconnected to the Public Switched Telephone Network are governed by rules set forth in Section 2.0.1.

2.4.8 Aircraft Use

Governing Rule:

Herein, the term aircraft includes any vehicle able to depart from the ground for a time greater than ten seconds while suspended by an airfoil, buoyancy or dynamic thrust; thus, the term is used for aerostats, aerodynes, rockets, balloons, dirigibles, blimps, model airplanes, autogyros, helicopters, gliders, etc.

Mobiles, portables, hand-helds, base stations and repeaters may be used in aircraft. Once airborne, they must restrict their output to 5

Watts ERPi on all channels found on Table One (2.2.5.1) or Table Two (2.2.5.2).

This is more than enough power for even 80 km paths once the aircraft is 1500 feet AGL.

2.4.9 Push-To-Talk (PTT) Transmitter Key Requirement

Governing Rule:

This service limits transmitter key-time to that required for the transmission of traffic: voice transmitters must stop emitting (unkey) when the user stops talking, data transmitters unkey when their packet queue is sent or time has expired. With the exception of repeaters in the phone-patch mode, radio carriers sans traffic are allowed only briefly: occasional testing and limited repeater timeout; see Section 2.0.1 for repeater phone-patch mode exception.

[This even limits duplex mobile phone calls to push-to-talk interconnections on the mobile side. Likely, this take-turns conversation structure will make Cellular, where available, more attractive. Economics will drive this service toward PTT because full duplex mobiles require costly radio components, given only 5 MHz Tx/Rx split. Since GMRS/FRS is a shared service with an emergency communication component, PTT is appropriate: allowing more opportunity for urgent interruptions.]

2.4.10 Voice Scrambling, Encryption & Interoperability

Governing Rule:

As long as the InteropMode requirements at Section 2.2 and the MonitorMode requirements at Section 2.4.5 are met, voice scrambling and voice or data encryption are permitted.

Scrambling and encryption cannot be discussed without asking: why not? Many comments circumvent their reasons while they vehemently oppose scrambling. Some argue: scrambling is annoying to hear. No one yet, claims that because these channels are shared, others have a right to eavesdrop. Tone squelch, not prohibition, will take care of annoying audio.

The Commission and a few others suggest a valid argument: users need to communicate about sharing the channel. Thus, they need interoperability; which they assume, precludes voice scrambling. Communication toward channel sharing is resolved in Section 2.2 without prohibiting scrambling and encryption.

Scrambling serves a worthy goal: it obstructs identity theft and other harmful acts based on the revelation of information. If GMRS/FRS systems are to be shared by friends and neighbors (as they need to be) users should be able to talk in confidence about any legitimate topic.

While nefarious use of two-way radio as it relates to scrambling was not an overt issue in the NPRM comments, it has been explored in the past and may be the reason for the current Part 95.181(c). Hampton argues that people engaged in criminal activity will find a way to veil their language even if scrambling or encryption is prohibited. When encryption is allowed, perverse users may feel more secure and be lulled into technical dependency. While encryption will thwart casual eavesdroppers, the sophisticated (law enforcement) will decrypt the transmission and hear unguarded conversation. A benefit.

As Garmin and Uniden point out, the type of voice cloaking used in GMRS/FRS radios is not likely to be very robust. Even robust algorithmically based encryption is often less effective than an unknown language (now permitted) or a specially compiled vocabulary (e.g., crazy white man for Adolf Hitler). In the Second World War, the Axis powers were not served as well by their technological solutions as the Allies were by "code talkers" using these techniques and plain voice transmissions. Furthermore, dealing with obscure language and structured vocabulary coding is an enforcement nightmare: the litigation effort is probably greater than the decrypting effort -- especially when a manufacturer will help. Testimony presenting decrypted unguarded conversation is likely to achieve better results than expert speculation about the true meaning of: "going to the mattresses."

Forbiding encryption is contrary to the public interest. Not only is it an overreaction, it has unintended consequences. When Rules demand that everyone understands all traffic, important innovation is thwarted. Since FM receivers are unlikely to understand sideband transmitters, which emission should be excluded? In this example, FM users may be clueless as to the sideband message content but they know the channel is occupied; just like scrambling or encryption.

The solution seems simple to Hampton: allow many modes, including voice scrambling, encryption or digital encoding -- but, require a readily achieved interoperable mode. When channel coordination is needed, use the common legacy mode: plain voice and F3E/G3E transmissions. All radios should have it; legacy radios already have it; radios with other modes should easily switch to the interoperable mode. This plan adds very little to radio cost because modern radios use digital signal processors that would only require a firmware upgrade. The InteroperableMode will also be used for emergency use (see 2.2.4).

Section Three
POTENTIAL INTERNATIONAL ISSUES

This plan and its radios could be an important international idea. Many places need two-way radio systems using simple low cost infrastructure able to be rapidly deployed and maintained in remote places by industrious people with little training.

As needed, this basic infrastructure should have a path to more utility and complexity while compatibly supporting an installed base of simple radios.

The ubiquitous bubble-pack GMRS/FRS radios are already used in Mexico, Canada, Central America, South America and even Africa. The equipment standardization suggested herein will result in a broad range of radio system building blocks for the out-back anyplace.

3.1 Regional Allocation Compatibility & Free Travel

There are already international issues. At least several ITU Region 2 countries offer GMRS/FRS types of service on frequencies shared with GMRS/FRS in the United States. Tourist purchases of U.S. low cost bubble-pack radios is less a problem when these souvenirs go home to Region 2. If they go back to remote Africa, they may not even be noticed.

They probably will be noticed in Europe -- just as U.S. amateurs notice visiting PRM446 radios. This is likely to be an issue in the impending ITU meetings. Setting aside the GMRS/FRS portions of 462/467 MHz in remote parts of Region 1 and Region 3 may not be too hard. Europe will be a challenge only equaled by moving GMRS/FRS in Region 2.

3.2 Line A, Line C, & Canadian Compatibility

Nearly identical Canadian and United States GMRS/FRS is suggested here. Canada and the United States already have much compatibility in these services.

While Canada has a service similar to the current U.S. Family Radio Service, they do not appear to allow repeaters, base stations, traditional mobiles and 50 Watts of output power. One could speculate the Minister of Industry has concerns over these enhancements in an unlicensed service (as they should).

It appears that Canada could incorporate this whole plan, including licensing and equipment types -- with little perturbation for their current rules. Canadian and FCC type acceptance could be reciprocally recognized. Then, both countries benefit from economies of scale. Canada, due to their vast areas of thin population density, may need this service even more than the U.S.

Such a result could facilitate the removal of line A and line C restriction on the GMRS/FRS frequencies (Part 95.35(2)). In short, a radio service with happy North American users -- all able to talk to one another and freely take their radios across the boarder.

Section Four

Statement of Qualifications

Gary A. Hampton has been deeply involved with Land Mobile Radio (LMR) since the 1960s when he earned an Amateur Radio License. By 1970 he became an FCC First Class Radiotelephone Operator and a GMRS licensee in 1980. After working for a General Electric repair shop, he opened a two-way radio business designing, selling and supporting many Public Safety and private LMR systems. After selling this business, Hampton joined Dale N. Hatfield Associates as a land mobile radio communications consultant where he co-authored various studies and FCC comments with Hatfield and others. While with Hatfield, he also did broadcast transmission and communication system design for a variety of commercial clients. Hampton has been an advisor to the Colorado chapter of APCO’s Engineering and Frequency Coordination Committees. Later, while Chairman of the Board for AmeriCom Corporation (Atlanta), he served on the Commission’s National Public Safety Planning Advisory Committee -- after which he founded Open Architecture Radio for Public Safety (OARPS). OARPS was formed to encourage more effective radio interoperability among public safety organizations; it terminated its efforts when APCO Project 25 became a reality. More recently, Hampton served at the National Center for Atmospheric Research (NCAR) helping them develop remote communication and data collection techniques and systems supporting their scientific mission. Currently, Hampton is the Chief Technologist for Hampton Technologies, Inc.